DOCUMENT RESUME

ED 258 497 HE 018 405

AUTHOR Bottomley, Wayne N.; Leonora, Arnold B.
TITLE Intersectional Grade Distribution Analysis. SAIR Conference Paper.
PUB DATE Oct 84
NOTE 24p.; Data table contain light type.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *College Instruction; Comparative Analysis; Course Content; *Courses; *Grades (Scholastic); *Grading; Higher Education; Institutional Research; Student Evaluation
IDENTIFIERS *Embry Riddle Aeronautical University FL; SAIR Conference

ABSTRACT

Differences in grades received by students in different sections of the same college course were evaluated at Embry-Riddle Aeronautical University in fall 1983 and compared to spring 1983 findings. After determining grades for each section of a particular course, the chi-square test for "k" independent samples was applied to the data to determine if there were statistically significant differences in grade distributions by section. In fall 1983, 26.6 percent of all courses had significant differences in the outcome distribution of grades between sections. This is an increase of 12.5 percent compared to spring term 1983 findings. While some of the differences may be due to unusual differences in student groups between sections, some may result from different presentations of material or through different evaluation and grading procedures. It is suggested that colleges should enforce measures designed to give students a fair and equivalent opportunity for a grade in a course regardless of the section, thus ensuring a reasonable level of consistency both in instructional content and in evaluation practices. An array of data tables are appended. (SW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED258497

INTERSECTIONAL GRADE DISTRIBUTION ANALYSIS

Report by:

Wayne N. Bottomley,
Director of Institutional Research
Arnold B. Leonora, Student Assistant
Office of Institutional Reserach
Embry-Riddle Aeronautical University
Daytona Beach, Florida 32014
(904) 252-5561
Ext. 1100

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

SAIR

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

IAED18405

Presented at the 1984 Annual Conference of the
Southern Association of Institutional Research
Little Rock, Arkansas
October 1984

INTERSECTIONAL GRADE DISTRIBUTION ANALYSIS

ABSTRACT

Wayne N. Bottomley and Arnold R. Leonora
Embry-Riddle Aeronautical University

In most colleges and universities today, large numbers of students are taught specific course material through multiple sections of particular courses. In many cases, different instructors teach different sections of the "same" course. It is generally assumed that through this academic delivery procedure, students will have an equivalent opportunity for learning a specified (and co-ordinated) amount of material, and for achieving a particular outcome measure (grade) reflective of their efforts, regardless of course section.

However, current research at one University suggests that this may not necessarily be the case in all courses with multiple sections. While there are currently significant efforts to coordinate course content over multiple sections of the same course, current research findings indicate that in some instances, major differences occur in outcome measures (grade distributions) between sections of courses. Even though this research does not indicate reasons for these differences, the results may still indicate a cause for concern if the differences are the result of major discrepancies in either course content, academic delivery modes, or evaluation procedures between sections.

This research utilizes a chi-square test for "k" independent samples to present a readily-understandable and easily interpreted model for monitoring academic outcome measures between course sections, allowing for a maximum of tolerance for individual differences, and a minimum of time and effort in the monitoring process. This can be used by academic management to monitor outcomes and to identify major anomolies for the possibility of corrective action, if and when such action is warranted.

INTERSECTIONAL GRADE DISTRIBUTION ANALYSIS

Wayne N. Bottomley and Arnold B. Leonora
Embry-Riddle Aeronautical University

INTRODUCTION

When institutions of higher education offer courses to students, in many cases multiple sections of particular courses are offered. There is a built-in assumption with this practice that a student has an equivalent opportunity for a grade reflective of his or her achievement in a subject, regardless of the section. That is, the section does not matter as much as the course and the student's own abilities. However, individuals familiar with registration processes and student arguments find that students frequently will go to great lengths to modify their schedules just to avoid a particular instructor or to get into a section with another instructor. And although much attention has been given to a whole host of evaluative measures of instruction, the bottom line may very well be that the student may feel that he or she is offered a better opportunity for a particular grade dependent upon the section (and hence the instructor) of a particular course. Based on an analysis of grade distributions between sections of courses at Embry-Riddle Aeronautical University, some significant differences in grade distributions between sections of particular courses are apparent. Certain latitude must be offered when reviewing grade distributions, for very real differences may exist between student groups (or students in sections). Therefore, this is not so much an attempt to "second guess" as it is an effort to review and ensure reasonable consistency between intersectional grading practices allowing for instructor and student group differences.

A review of the literature shows that almost no attention has been paid to this particular issue in the past although there have been numerous efforts to identify grading differences based on factors of race (Bertelson, et. al, 1982), or personality traits (Taylor, 1973). Comparisons of data have been many and varied using a number of statistical tests, but for this particular effort, a chi-square test for "k" indepen-

SOUTHERN ASSOCIATION FOR INSTITUTIONAL RESEARCH

This paper was presented at the 1984 Annual Conference of the Southern Association for Institutional Research held in Little Rock, Arkansas, October 24-26, 1984. It was reviewed by the SAIR Publications Committee and was judged to be of interest and pertinent to others concerned with the research in higher education. This paper has therefore been selected to be included in the ERIC collection of Conference Papers.

Richard D. Howard
President, SAIR

INTRODUCTION (continued):

dent samples was utilized. We did find that this and other tests of differences between groups had been utilized frequently in the past in similar groupings (Katz & McSweeney, 1984; Rae, 1982; Hsu, 1980; Besag, 1980, to name but a few) where sample groups were statistically independent, but assumed to be from the same general population (which is the assumption made in this case).

METHODOLOGY

The basic methodology of the chi-square test used can be found in most good texts of non-parametric statistics (we used Siegel, 1956) for the basis for this project. Data for this report was obtained from the CISSTU data base at E-RAU. Grades for the Fall 1983 academic term (trimester) were tabulated for each section of a particular course. Letter grades for audits (AU) are excluded. The chi-square test for "k" independent samples was then applied to this data to determine if there were statistically significant differences in the distribution depending upon the section of a given course. Some detail on this testing procedure is included in the Appendix to this report.

The chi-square test produces a specific number which is then compared to a table of "critical values" (at a determined degree of freedom level) to see if the result is statistically significant. In order to allow sufficient "room" for individual differences in the composition of a class and in teaching style, two separate alpha levels were used, alpha = .05 and alpha = .001. Essentially, these levels indicate the possibility that the results (for comparison to table values) could be obtained through random chance. The .05 alpha level produces a critical value (CV) lower than the alpha level of .001, thus indicating a greater possibility of random generation of results (and hence, more possibility of errors in determination of significance), yielding more latitude for instructional differences. For this analysis, we can use the alpha levels with the following meanings:

alpha = .05 — At this level, a calculated chi-square value greater than the CV <u>may</u> indicate a cause for concern in grading outcomes between different sections of a given course.

alpha = .001 At this level, if a calculated chi-square is greater than the CV, there are definitely statistically significant differences in grade distributions between sections of a given course.

The chi-square analysis procedure was applied to each course which had more than one section in Fall 1983. Results of the chi-square calculations were compared with the CVs to determine if differences observed were significantly different from results which could be obtained through random chance.

RESULTS

The chi-square tests showed 53 courses (an increase of 76.7% when compared to results of a similar study in Spring 1983) that were critical at the level alpha = .05, indicating that we may have a cause for concern in grading outcomes between sections of these courses. These 53 courses were:

TABLE A

ACADEMIC COURSES WITH STATISTICALLY SIGNIFICANT DIFFERENCES IN GRADE DISTRIBUTIONS BETWEEN SECTIONS OF THE SAME COURSE (alpha = .05)

COURSE	NUMBER OF SECTIONS	CHI-SQUARE VALUES	CRITICAL VALUES
AE 304	03	18.39	18.31
AE 401	02	17.89	11.07
AE 420	03	15.76	15.51+
AMT 204	04	27.54	25.00+
AMT 208	05	36.31	31.41+
AMT 210	06	41.01	37.65+
AMT 211	06	39.21	37.65+
AS 100	15	101.92	90.53
AS 101	14	131.04	90.53+
AS 102	05	40.12	31.41
AS 203	06	55.18	37.65+
AS 210	05	34.96	31.41
AS 303	12	133.24	79.08+
AS 307	06	47.03	37.65+
AS 309	04	34.34	25.00
AS 311	04	21.50	21.03
AS 412	04	37.65	25.00+
AV 301	04	59.08	21.03+
CS 109	16	153.21	101.88+
CS 110	06	54.42	37.65
CS 210	05	39.46	31.41

TABLE A (continued)

COURSE	NUMBER OF SECTIONS	CHI-SQUARE VALUES	CRITICAL VALUES
EC 210	08	87.75	55.76+
EC 211	06	84.93	37.65+
EC 310	03	46.47	15.51
EL 222	02	10.61	9.49
ES 303	03	39.28	18.31
ET 101	03	28.53	18.31
ET 110	02	11.82	11.07
HU 105	18	353.08	113.15
HU 116	16	107.37	101.88
HU 120	28	214.63	162.83
HU 121	18	140.86	113.15
HU 220	17	193.17	101.88+
HU 221	20	191.04	124.34+
HU 250	07	65.19	43.77+
MA 105	11	105.99	67.50
MA 112	09	79.09	55.76
MA 140	05	40.56	31.41
MA 241	07	58.77	55.76
MS 105	08	123.83	55.76+
MS 210	10	80.09	67.50+
MS 305	10	71.21	67.50
MS 311	04	38.14	21.03
MS 313	04	37.67	25.00
MS 315	02	29.20	11.07
MS 316	04	73.07	25.00+
MS 390	02	13.11	9.49
MS 401	03	18.62	18.31
MS 425	03	19.99	12.59
PS 101	07	44.09	37.65
PS 104	07	46.31	43.77+
PS 201	04	33.96	25.00+
SS 220	06	117.13	37.65

NOTE: 1) Differences are significant when chi-square is > CV

2) "+" denotes courses that were also critical at the .05 alpha level during previous (Spring Term) studies.

Of the 53 courses listed above, 23 were critical at the level alpha = .001 (up 283.3% compared with Spring 1983 reports), which means that in these 23 courses we definitely do have statistically significant differences between grading outcomes in different sections. These 23 courses were:

TABLE B

ACADEMIC COURSES WITH STATISTICALLY SIGNIFICANT DIFFERENCES IN GRADE DISTRIBUTIONS BETWEEN SECTIONS OF THE SAME COURSE (alpha = .001)

COURSES	NUMBER OF SECTIONS	CHI-SQUARE VALUE	CRITICAL VALUES
AS 101	14	131.04	112.32
AS 203	06	55.18	37.65
AS 303	12	133.24	79.08
AV 301	04	59.08	32.91
CS 109	16	153.21	124.84+
CS 110	06	54.42	52.62
EC 210	08	87.75	73.40
EC 211	06	241.18	52.62
EC 310	03	46.47	26.13
ES 303	03	39.28	29.59
HU 105	18	353.08	137.21
HU 120	28	214.63	189.96
HU 121	18	140.86	137.21
HU 220	17	193.17	124.84+
HU 221	20	191.04	149.45
HU 250	07	65.19	59.70+
MA 105	11	105.99	86.66
MA 112	09	79.09	73.40
MS 105	08	123.83	73.40
MS 311	04	38.14	32.91
MS 315	02	29.20	20.52
MS 316	04	73.70	37.70
SS 220	06	117.13	52.62

NOTE: "+" denotes courses that were also critical at the .001 level during Spring 1983 analysis.

CONCLUSION

In Fall 1983, 26.63% of all the courses offered showed statistically significant differences in the outcome distribution of grades between sections. There were 215 total different courses offered in Fall 1983. This is an increase of 12.55% compared to an analysis conducted in Spring Term 1983. We cannot through this analysis, indicate why differences occurred. Some of these may have occurred due to very valid and logical events such as through unusual differences in student groups between sections of a particular course. But some may have occurred because of differences in presentation of material or through different evaluation and grading procedures. Also, some of these differences are

CONCLUSIONS (continued):

more pronounced than others. While some of the differences were significant at the alpha = .05 level, others produced such high chi-square values that they were significant at alpha = .001 level (meaning almost no chance that these differences occurred through random selection).

Comparing the overall analysis between Fall 1983 and Spring 1983, the Fall statistics showed an increase in the number of courses which had statistically significant differences in grade outcomes between sections at both alpha levels. Although 26.7% of the courses that were statistically significant in the Spring did not repeat during Fall 1983, 73.3% of the courses which showed up that first time did re-appear. 58.5% of the courses which produced statistically significant differences in grade outcomes between sections in Fall 1983 showed up for the first time.

The significance to this or to any other University occurs when these differences in grading outcomes between sections are caused by differences in instruction or in grading practices. While Universities need to leave room for individual differences in teaching style, institutions also need to maintain consistency in course offerings. An analysis of the reasons why these differences occurred may best be left to the individual departments. However, this report indicates some particular "beginning points" for such an examination, with first efforts focusing on those courses showing significant differences with an alpha level = .001.

The issue of reviewing grade distributions must also be handled with considerable sensitivity. Some, in the academic community, might be inclined to view this as an unwarranted intrusion into their "academic freedom". However, from an institutional perspective, we must weigh these issues carefully, especially when collegiate credentials are at stake, for the issues related to opportunities for fair evaluation and grade point average production, remain with students for the remainder of their lives affecting student's career paths and their eventual earning power. The argument posed here is not that a collegiate administration should constantly peer over the shoulder of the academic community to ensure an

CONCLUSIONS (continued):

equal distribution of grades over sections, but that the institution should establish and enforce measures designed to give students a fair and equivalent opportunity for a grade in a course regardless of the section, thus ensuring a reasonable level of consistency both in instructional content and delivery and in evaluation practices. As most who have recently passed through the halls of academe realize, this could be considered a presently-existing shortcoming.

REFERENCES

Bertelson, A. D.; Marks, P. A.; and May, G. D., MMPI and Race: A Controlled Study, Journal of Consulting and Clinical Psychology, April 1982, Vol. 50 (2). PSYCINFO no. 68-00113.

Besag, F. P., Academic Science, Policy Decisions, and Chi-Square, Urban Education, July 1980, Vol. 15 (2). ERIC no. EJ229216.

Bottomley, Wayne N., and Leonora, A. B., Intersectional Grade Distribution Analysis: An Examination of Grading Practices in Multiple Section Courses for Spring 1983 (unpublished), E-RAU, Daytona Beach, Florida.

Hsu, L. M., A Chi-Squared/D.F. Test for Interaction in Two-Treatment Repeated Measurements Designs, Educational and Psychological Measurement, Summer 1980, Vol. 40 (2). ERIC no. EJ233313.

Katz, B. M., and McSweeney, M., Analysis of Categorical Data When Subjects Can Appear in Any Number of Categories, Journal of Experimental Education, Winter 1984, Vol. 52 (2). ERIC no. EJ297530.

Rae, G., On Tideman's Generalized Chi-Square Statistic, Education and Psychological Measurement, Summer 1982, Vol. 42 (2). ERIC no. EJ266474.

Siegel, S., Nonparametric Statistics for the Behavioral Sciences, McGraw-Hill Book Company, New York, Toronto, London, 1956.

Taylor, H., Personality and Achievement of Athletic and Non-Athletic High School Girls, Research Report, May 1973. ERIC no. ED114726

ATTACHMENT: Data Appendix

DATA APPENDIX

APPENDIX:

Chi-Square Formula for "k" Independent Samples:

$$X^2 = \sum_{r} \sum_{k} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

where:
- r = total number of rows
- k = total number of columns
- O_{ij} = Observed frequency in a cell
- E_{ij} = Expected frequency in a cell

Critical Values:

TABLE C. TABLE OF CRITICAL VALUES OF CHI SQUARE*

df	Probability under H_0 that $x^2 \geq$ chi squared													
	.99	.98	.95	.90	.80	.70	.50	.30	.20	.10	.05	.02	.01	.001
1	.00016	.00063	.0039	.016	.064	.15	.46	1.07	1.64	2.71	3.84	5.41	6.64	10.83
2	.02	.04	.10	.21	.45	.71	1.39	2.41	3.22	4.60	5.99	7.82	9.21	13.82
3	.12	.18	.35	.58	1.00	1.42	2.37	3.66	4.64	6.25	7.82	9.84	11.34	16.27
4	.30	.43	.71	1.06	1.65	2.20	3.36	4.88	5.99	7.78	9.49	11.67	13.28	18.46
5	.55	.75	1.14	1.61	2.34	3.00	4.35	6.06	7.29	9.24	11.07	13.39	15.09	20.52
6	.87	1.13	1.64	2.20	3.07	3.83	5.35	7.23	8.56	10.64	12.59	15.03	16.81	22.46
7	1.24	1.56	2.17	2.83	3.82	4.67	6.35	8.38	9.80	12.02	14.07	16.62	18.48	24.32
8	1.65	2.03	2.73	3.49	4.59	5.53	7.34	9.52	11.03	13.36	15.51	18.17	20.09	26.12
9	2.09	2.53	3.32	4.17	5.38	6.39	8.34	10.66	12.24	14.68	16.92	19.68	21.67	27.88
10	2.56	3.06	3.94	4.86	6.18	7.27	9.34	11.78	13.44	15.99	18.31	21.16	23.21	29.59
11	3.05	3.61	4.58	5.58	6.99	8.15	10.34	12.90	14.63	17.28	19.68	22.62	24.72	31.26
12	3.57	4.18	5.23	6.30	7.81	9.03	11.34	14.01	15.81	18.55	21.03	24.05	26.22	32.91
13	4.11	4.76	5.89	7.04	8.63	9.93	12.34	15.12	16.98	19.81	22.36	25.47	27.69	34.53
14	4.66	5.37	6.57	7.79	9.47	10.82	13.34	16.22	18.15	21.06	23.68	26.87	29.14	36.12
15	5.23	5.98	7.26	8.55	10.31	11.72	14.34	17.32	19.31	22.31	25.00	28.26	30.58	37.70
16	5.81	6.61	7.96	9.31	11.15	12.62	15.34	18.42	20.46	23.54	26.30	29.63	32.00	39.29
17	6.41	7.26	8.67	10.08	12.00	13.53	16.34	19.51	21.62	24.77	27.59	31.00	33.41	40.75
18	7.02	7.91	9.39	10.86	12.86	14.44	17.34	20.60	22.76	25.99	28.87	32.35	34.80	42.31
19	7.63	8.57	10.12	11.65	13.72	15.35	18.34	21.69	23.90	27.20	30.14	33.69	36.19	43.82
20	8.26	9.24	10.85	12.44	14.58	16.27	19.34	22.78	25.04	28.41	31.41	35.02	37.57	45.32
21	8.90	9.92	11.59	13.24	15.44	17.18	20.34	23.86	26.17	29.62	32.67	36.34	38.93	46.80
22	9.54	10.60	12.34	14.04	16.31	18.10	21.24	24.94	27.30	30.81	33.92	37.66	40 29	48.27
23	10.20	11.29	13.09	14.85	17.19	19.02	22.34	26.02	28.43	32:01	35.17	38.97	41.64	49.73
24	10.86	11.99	13.85	15.66	18.06	19.94	23.34	27.10	29.55	33.20	36.42	40.27	42.98	51.18
25	11.52	12.70	14.61	16.47	18.94	20.87	24.34	28.17	30.68	34.38	37.65	41.57	44.31	52.62
26	12.20	13.41	15.38	17.29	19.82	21.79	25.34	29.25	31.80	35.56	38.88	42.86	45.64	54.05
27	12.88	14.12	16.15	18.11	20.70	22.72	26.34	30.32	32.91	36.74	40.11	41.14	46.96	55.48
28	13.56	14.85	16.93	18.94	21.59	23.65	27.34	31.39	34.03	37.92	41.34	45.42	48.28	56.89
29	14.26	15.57	17.71	19.77	22.48	24.58	28.34	32.46	35.14	39.09	42.56	46.69	49.59	58.30
30	14.95	16.31	18.49	20.60	23.36	25.51	29.34	33.53	36.25	40.26	43.77	47.90	50.89	59.70

* Table C is abridged from Table IV of Fisher and Yates: *Statistical tables for biological, agricultural, and medical re* published by Oliver and Boyd Ltd., Edinburgh, by permission of the authors and publishers.

Chi-Square Greater than $\alpha = .001$

AS 101

Section	Frequency of Grades A	B	C	D	F	W	Total
02	6	10	4	2	2	7	32
03	2	12	6	2	6	7	35
04	7	13	5	2	0	1	28
05	3	18	21	3	2	3	50
06	7	5	10	6	8	4	40
07	6	27	18	3	3	2	59
08	4	13	14	1	1	2	35
09	8	11	14	2	0	0	35
11	4	15	10	2	1	3	35
12	7	14	28	3	5	4	61
13	4	11	11	3	2	4	35
14	5	12	13	2	1	2	35
15	3	9	9	9	3	2	35
16	2	12	19	1	1	1	36

Total of Frequencies A	B	C	D	F	W	Total
68	187	192	41	36	42	566

AS 203

Section	Frequency of Grades A	B	C	D	F	W	Total
02	2	5	10	2	10	0	29
03	3	5	9	10	1	1	29
04	8	15	7	2	2	0	34
05	6	9	4	4	2	1	26
06	5	9	9	2	4	3	32
07	1	3	9	3	2	3	21

Total of Frequencies A	B	C	D	F	W	Total
25	46	48	23	21	8	171

Chi-Square Greater than $\alpha = .001$

AS 303

Section	Frequency of Grades A	B	C	D	F	W	Total
01	3	5	9	2	1	7	27
02	6	10	16	1	0	2	35
03	3	13	9	0	1	3	34
04	5	13	9	1	2	1	36
05	2	13	18	2	1	2	38
06	1	14	18	0	1	1	35
07	9	11	9	3	0	4	36
08	3	14	14	0	1	4	36
09	2	12	10	6	0	2	32
10	11	18	3	0	0	3	35
11	10	12	3	0	3	3	31
12	0	4	12	7	2	4	29

Total Frequencies A	B	C	D	F	W	Total
55	149	130	22	12	36	404

AV 301

Section	Frequency of Grades A	B	C	D	F	W	Total
01	25	6	0	0	0	0	31
02	23	9	0	0	0	1	33
03	28	9	0	0	0	2	38
04	2	7	7	1	0	2	19

Total Frequencies A	B	C	D	F	W	Total
78	31	7	1	0	5	122

Chi-Square Greater than $\alpha = .001$

CS 109

Section	Frequency of Grades						Total
	A	B	C	D	F	W	
01	8	4	6	1	1	10	30
02	2	4	2	3	9	8	28
03	11	6	6	2	1	5	31
04	8	9	5	2	0	7	31
05	5	15	9	0	1	1	31
06	6	7	11	1	1	3	29
07	6	12	5	3	2	1	29
08	4	8	9	2	2	6	31
09	3	6	3	0	10	7	29
10	4	6	5	5	4	4	28
11	9	9	6	1	0	6	31
12	6	7	6	5	1	5	30
13	8	4	13	0	1	6	32
14	3	2	4	3	5	6	23
15	4	4	4	2	3	2	19
16	10	5	1	0	2	10	28

Total Frequencies						
A	B	C	D	F	W	Total
97	108	95	30	43	87	460

CS 110

Section	Frequency of Grades						Total
	A	B	C	D	F	W	
01	5	1	4	2	4	6	22
02	6	10	8	0	1	5	30
04	6	9	1	1	2	3	22
05	15	5	0	2	4	3	29
06	3	8	1	4	3	6	25
07	11	5	0	0	3	10	29

Total Frequencies						
A	B	C	D	F	W	Total
46	38	14	9	17	33	157

Chi-Square Greater than $\alpha = .001$

EC 210

Section	Frequency of Grades A	B	C	D	F	W	Total
01	9	6	26	2	3	8	54
02	9	16	23	3	3	6	60
03	16	24	12	5	1	2	60
04	4	24	9	12	2	6	57
05	6	15	9	18	2	7	57
06	10	17	13	8	3	2	53
07	10	14	15	2	0	10	54
08	7	12	19	7	4	9	58

Total Frequencies A	B	C	D	F	W	Total
71	128	129	57	18	50	453

EC 211

Section	Frequency of Grades A	B	C	D	F	W	Total
01	2	11	12	3	3	2	33
02	8	21	12	9	2	8	60
03	5	18	14	13	3	5	58
05	7	6	19	17	4	6	59
06	5	20	15	5	4	5	54
07	8	12	8	4	13	5	50

Total Frequencies A	B	C	D	F	W	Total
35	88	80	51	29	31	314

EC 310

Section	Frequency of Grades A	B	C	D	F	W	Total
01	19	13	6	4	0	0	42
02	7	12	6	0	0	1	26
03	14	16	2	1	0	2	35

Total Frequencies A	B	C	D	F	W	Total
40	41	14	5	0	3	103

Chi-Square Greater than α = .001

HS 303

Section	Frequency of Grades A	B	C	D	F	W	Total
01	2	2	1	5	5	7	22
02	3	2	6	5	6	3	23
03	1	11	17	0	0	2	31

Total Frequencies A	B	C	D	F	W	Total
6	15	24	10	11	12	78

HU 105

Section	Frequency of Grades A	B	C	D	F	W	Total
01	0	5	5	3	6	3	22
02	0	6	2	1	13	0	22
03	2	6	5	4	4	1	22
04	0	2	7	0	9	5	23
05	0	7	7	2	6	0	22
06	2	3	5	0	7	4	21
07	1	4	10	0	3	3	21
08	1	7	12	2	1	1	24
09	1	4	12	2	1	2	22
10	2	3	11	1	3	1	21
11	0	2	10	0	4	6	22
12	0	10	3	0	7	2	22
13	1	7	7	1	0	1	17
14	1	12	5	2	0	2	22
15	1	3	9	5	2	2	22
16	0	4	14	1	3	0	22
17	3	3	9	4	1	3	23
18	0	2	3	10	1	2	18

Total Frequencies A	B	C	D	F	W	Total
15	90	136	38	71	38	388

Chi-Square Greater than $\alpha = .001$

HU 120

Section	Frequency of Grades A	B	C	D	F	W	Total
01	1	7	6	2	3	3	22
02	1	2	4	3	5	7	22
03	1	4	9	2	2	6	24
04	1	3	5	2	4	5	22
05	2	8	3	1	2	6	22
06	1	3	10	2	2	3	21
07	4	3	8	0	3	6	24
08	3	6	10	0	2	1	22
09	5	7	2	0	7	1	22
10	6	8	7	0	0	1	22
11	2	9	6	0	2	0	19
12	1	6	5	1	2	5	20
13	2	6	4	2	0	8	22
14	0	3	11	0	2	7	23
15	0	8	4	3	3	3	21
16	1	10	7	1	0	3	22
17	0	8	11	0	1	0	20
18	5	5	9	0	0	1	20
19	0	11	7	1	0	3	22
20	3	7	12	0	0	0	22
21	0	8	7	1	1	4	21
22	0	9	7	2	2	3	23
23	3	12	4	2	0	1	22
24	2	9	8	1	3	2	25
25	1	9	7	1	1	3	22
26	1	8	7	2	0	1	19
27	3	3	5	0	2	1	14
28	0	2	4	4	2	3	15

Total Frequencies A	B	C	D	F	W	Total
49	186	189	33	51	87	595

Chi-Square Greater than $\alpha = .001$

HW 121

Section	Frequency of Grades A	B	C	D	F	W	Total
01	0	2	4	3	2	7	18
02	0	5	12	1	1	2	21
03	2	6	14	0	0	0	22
04	1	10	7	1	1	3	23
05	3	13	3	0	0	0	19
06	3	3	7	0	1	2	16
07	1	12	3	0	0	2	18
08	2	4	4	1	3	4	18
09	2	3	3	3	0	3	19
10	2	6	4	0	4	5	21
11	4	10	6	0	0	2	22
12	0	5	8	4	0	5	22
13	4	3	7	0	1	6	21
14	0	7	6	0	1	6	20
15	4	7	3	2	3	2	21
16	3	8	8	4	0	3	26
17	2	5	2	0	1	1	11
18	1	4	4	0	0	1	10

Total Frequencies A	B	C	D	F	W	Total
34	118	105	19	18	54	348

HW 220

Section	Frequency of Grades A	B	C	D	F	W	Total
01	1	13	2	0	0	3	19
02	1	13	4	0	0	1	19
03	1	8	10	0	1	1	21
04	2	14	4	0	0	2	22
05	2	13	7	0	0	0	22
06	4	13	4	0	0	1	22
07	4	15	2	0	0	1	22
08	7	10	0	0	0	1	18
09	9	9	0	0	1	2	21
10	5	14	1	0	0	1	21
11	6	11	3	0	0	1	21
12	6	13	2	0	0	1	22
13	3	12	0	0	0	5	20
14	2	11	2	0	1	2	18
15	9	8	0	0	0	2	19
16	14	4	0	0	0	0	18
18	0	11	4	3	2	0	20

Total Frequencies A	B	C	D	F	W	Total
76	192	45	3	5	24	345

Chi-Square Greater than $\alpha = .001$

HW 221

Section	Frequency of Grades						
	A	B	C	D	F	W	Total
01	2	7	8	1	2	2	32
02	2	16	3	0	2	0	23
03	4	15	3	0	0	2	26
04	6	11	6	0	0	0	23
05	13	4	0	0	1	2	22
06	10	10	1	0	0	1	22
07	2	11	4	0	2	3	22
08	2	8	8	0	0	2	21
09	8	8	5	2	0	1	22
10	12	4	1	0	0	4	22
11	3	8	6	2	1	1	21
12	2	9	3	1	4	4	23
13	3	8	5	1	3	2	22
14	2	8	4	0	4	3	22
15	4	10	4	0	1	2	21
16	3	6	3	0	3	5	20
17	3	8	9	2	0	0	22
18	4	8	2	0	0	3	17
19	1	6	3	3	0	1	14
20	2	3	2	0	1	5	14

Total Frequencies						
A	B	C	D	F	W	Total
89	167	83	12	24	46	421

HW 250

Section	Frequency of Grades						
	A	B	C	D	F	W	Total
01	9	5	8	4	1	3	30
02	17	15	7	2	1	7	49
03	8	12	22	4	1	3	50
04	13	14	8	1	3	9	48
05	18	21	7	1	0	3	50
06	8	22	11	3	2	5	51
07	1	2	4	2	2	1	12

Total Frequencies						
A	B	C	D	F	W	Total
74	91	67	17	10	31	290

Chi-Square Greater than α = .001

EN 105

Section	Frequency of Grades						
	A	B	C	D	F	W	Total
01	2	3	6	4	16	3	34
02	2	1	10	0	17	3	33
03	3	6	6	3	9	5	32
04	2	3	4	1	18	5	33
05	2	4	7	0	14	1	32
06	1	4	4	9	11	2	33
07	3	9	6	3	11	2	34
08	2	2	6	0	19	0	33
09	4	8	13	10	0	1	34
10	3	6	7	0	15	3	34
11	6	7	11	0	8	3	35

Total Frequencies						
A	B	C	D	F	W	Total
32	58	80	30	136	31	367

EN 112

Section	Frequency of Grades						
	A	B	C	D	F	W	Total
01	3	2	5	11	3	9	33
02	3	8	12	3	2	6	34
03	2	6	9	1	5	7	30
04	0	3	4	8	7	6	28
05	0	2	11	8	6	5	32
06	1	2	3	6	8	6	26
07	2	5	12	2	1	8	30
08	4	3	4	4	10	5	30
09	8	5	1	5	5	4	28

Total Frequencies						
A	B	C	D	F	W	Total
23	36	61	48	47	56	271

Chi-Square Greater than $\alpha = .001$

MS 105

Section	Frequency of Grades A	B	C	D	F	W	Total
01	13	29	13	1	3	4	63
02	12	33	7	0	1	4	57
03	11	33	16	0	2	4	66
04	7	28	17	4	1	4	61
05	31	16	7	2	2	5	63
06	24	14	5	1	2	4	50
07	36	20	1	0	0	5	62
08	2	7	5	3	2	4	25

Total Frequencies A	B	C	D	F	W	Total
136	180	71	13	13	34	447

MS 211

Section	Frequency of Grades A	B	C	D	F	W	Total
01	2	20	9	1	0	2	34
02	3	19	6	4	0	0	32
03	13	6	2	0	0	4	25
04	7	12	8	4	0	1	32

Total Frequencies A	B	C	D	F	W	Total
25	57	25	9	0	7	123

MS 315

Section	Frequency of Grades A	B	C	D	F	W	Total
01	9	23	2	0	0	0	34
02	11	3	4	1	3	9	31

Total Frequencies A	B	C	D	F	W	Total
20	26	6	1	3	9	65

Chi-Square Greater than $\alpha = .001$

HS 315

Section	Frequency of Grades A	B	C	D	F	W	Total
01	2	5	16	3	1	3	30
02	28	10	2	1	0	0	41
03	18	14	2	0	0	0	34
04	15	16	4	0	0	0	35

Total Frequencies A	B	C	D	F	W	Total
63	45	24	4	1	3	140

SS 220

Section	Frequency of Grades A	B	C	D	F	W	Total
01	5	7	36	19	4	8	79
02	4	11	33	10	8	12	78
03	1	27	14	4	1	0	47
04	2	16	22	6	0	4	50
05	3	27	29	12	4	3	78
06	4	23	15	7	1	2	52

Total Frequencies A	B	C	D	F	W	Total
19	111	149	58	18	29	384